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Schilling et al.

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(54) **CRASH-ACTIVE HEAD RESTRAINT**

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(30) **Foreign Application Priority Data**

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(51) **Int. Cl.**
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(52) **U.S. Cl.** **297/216.12**

(58) **Field of Classification Search** 297/216.12
See application file for complete search history.

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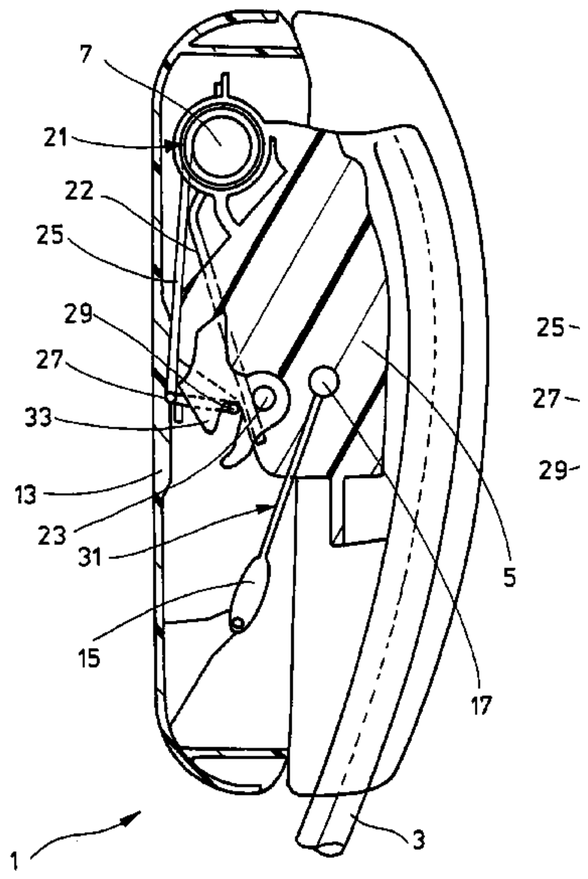
(57) **ABSTRACT**

In the case of a head restraint (**1**) for a vehicle seat, with a support (**5**), at least two rockers (**15**, **25**) which are arranged movably on the support (**5**) and are pivotable about horizontal spindles (**7**, **17**), an impact element (**13**) which is coupled to the rockers (**15**, **25**) and, with the rockers (**15**, **25**) and the support (**5**), forms at least one four-bar linkage (**31**), and a spring (**21**) as an energy accumulator which drives the four-bar linkage (**31**) in the event of a crash, so that the impact element (**13**) extends forward out of a starting position into a crash position, at least one leg (**25**) of the spring (**21**) forms one of the rockers.

22 Claims, 1 Drawing Sheet



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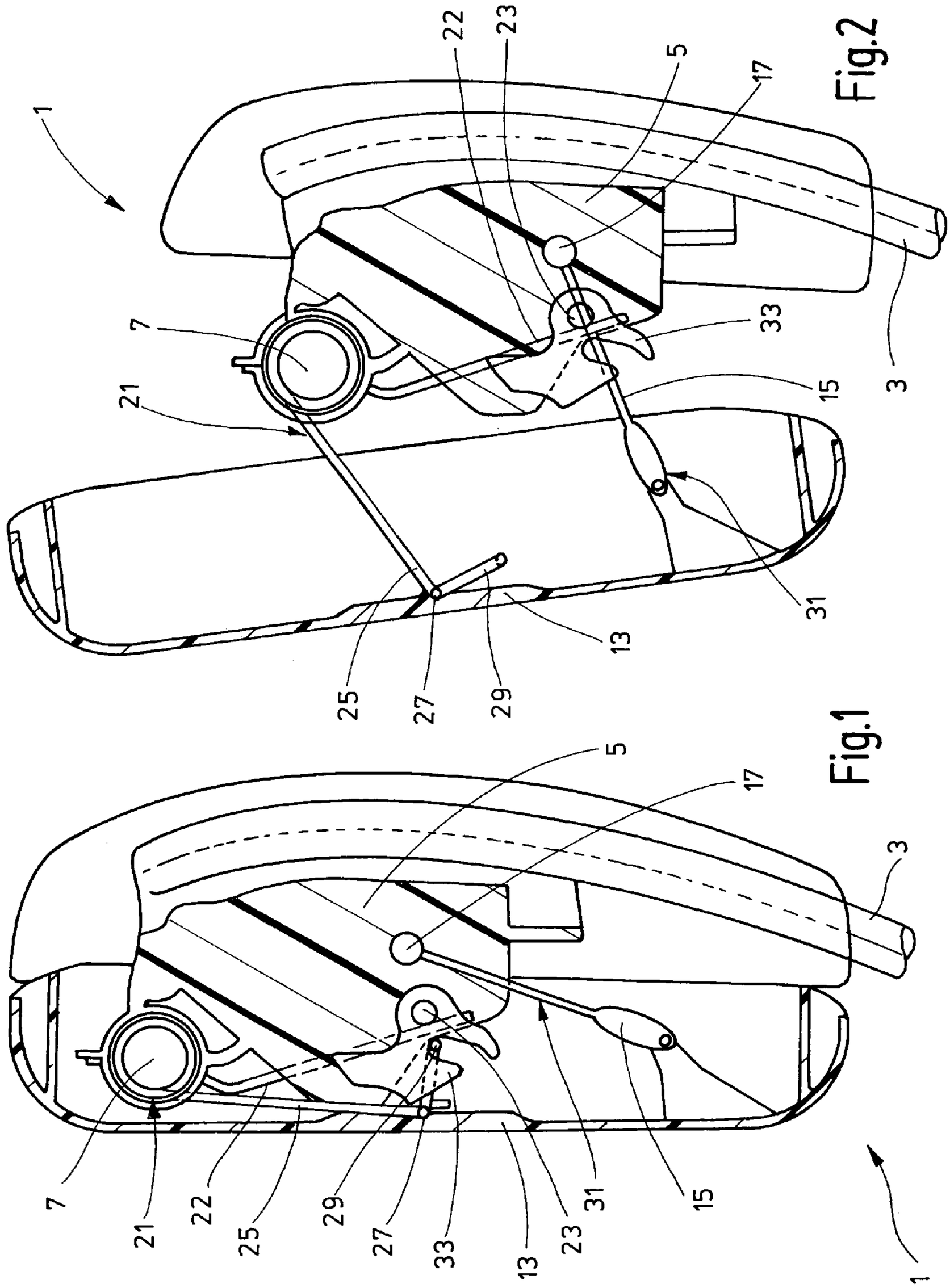
1
22
23
5
17
7
33
21
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3
25
27
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31

Fig.2

5
17
3
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21
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25
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33
13
23
31
15
1

Fig.1

CRASH-ACTIVE HEAD RESTRAINT

CROSS-REFERENCE TO RELATED APPLICATION

The present application is a continuation of International Application PCT/EP2005/006086, which was filed Jun. 7, 2005. The entire disclosure of International Application PCT/EP2005/006086, which was filed Jun. 7, 2005, is incorporated herein by reference.

BACKGROUND OF THE INVENTION

The present invention relates to a head restraint for a vehicle seat, with the head restraint including a support; at least two rockers which are arranged movably on the support and are pivotable about horizontal spindles; an impact element which is coupled to the rockers and, with the rockers and the support, forms at least one four-bar linkage; and a spring as an energy accumulator which drives the four-bar linkage in the event of a crash, so that the impact element extends forward out of a starting position into a crash position

DE 199 51 966 A1 discloses a head restraint of the type described immediately above, in which the impact element extends in the event of a crash by means of a four-bar linkage designed as a parallelogram, and a spring-loaded pivoting arm, which serves as the drive, acts upon the impact element and locks in the crash position.

BRIEF SUMMARY OF SOME ASPECTS OF THE INVENTION

An aspect of the present invention is the provision of improvements to a head restraint of the type mentioned above. In accordance with an aspect of the present invention, the head restraint includes a support; at least two rockers (e.g., pivotable members) that are carried by the support for respectively pivoting about horizontal axes (e.g., spindles of the support); an impact element that is connected to the rockers so that the impact element together with the rockers and the support forms at least one four-bar linkage; and a spring that is for accumulating energy and for driving the four-bar linkage in response to a crash, so that the impact element moves forwardly from a starting position to a crash position, wherein the spring includes at least one leg, and the leg is one of the rockers.

Because at least one leg of the spring forms one of the rockers, the number of required components is reduced, which reduces the production costs and simplifies the installation. The functionality of the crash-active head restraint remains unaffected in this case. The arrangement of the leg corresponds essentially to that of a rocker, i.e. the leg preferably protrudes radially from the associated spindle of the support. The spring is preferably partially wound up onto this spindle or itself forms the spindle by the spring being fixed in the support. The connection of the spring to the impact element takes place, for example, by means of a bent portion, shoulder or the like which then runs partially parallel to the spindle. The locking in the starting position takes place, for example, by means of an intercepting tongue, bent portion or the like which is held by a latch of the support.

The spring is preferably formed integrally from a continuous spring steel wire and is constructed symmetrically with respect to the center of the head restraint, which is defined by a vertical plane, in order to achieve a symmetrical

drive. The leg serving as the rocker is then preferably provided in duplicate and is provided, for example, in a central section of the spring where the bent portion(s) and the intercepting tongue, which is preferably placed between the legs, can also be provided. The leg or legs preferably form an upper rocker, with then in total two four-bar linkages being provided, each comprising a leg, a lower rocker and also the impact element and the support.

Other aspects and advantages of the present invention will become apparent from the following.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is explained in more detail below with reference to an exemplary embodiment illustrated in the drawings, in which:

FIG. **1** shows a side view of the exemplary embodiment in the starting position, and

FIG. **2** shows a view corresponding to FIG. **1** in the crash position.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENT

In the exemplary embodiment, a head restraint **1** for a vehicle seat of a motor vehicle is provided. The head restraint **1** can be adjusted in terms of its height by means of two parallel head restraint rods **3** that are mounted displaceably in the backrest of the vehicle seat. The arrangement of the head restraint **1** on the vehicle seat and the usual direction of travel of the motor vehicle define the directional details used. The head restraint rods **3** are fixedly secured at their upper ends in a support **5** arranged transversely with respect to the head restraint rods **3**. At the upper end of the support **5**, a horizontally arranged spindle **7** running transversely with respect to the head restraint rods **3** is defined in the support **5**. In the exemplary embodiment, the spindle **7** can be characterized as only being present mathematically (e.g., it can be characterized as being not physically present), but the spindle **7** can be physically present in a modified embodiment. The head restraint **1** is constructed essentially symmetrically with respect to a vertical central plane.

An impact element **13** is arranged in front of the support **5** in the direction of travel. A cushion part is arranged on the impact element **13**, with it being possible for the impact element **13** at the same time to be the cushion carrier, i.e. the cushion can be fastened directly to the impact element **13**. A pair of lower rockers **15** (e.g., pivotable members) of elongate design are coupled at one end to the support **5** in each case by means of a horizontal pivot/bearing bolt **17** which is parallel to the spindle **7**. The other ends of the lower rockers **15** are coupled to the lower end of the impact element **13**. A double leg spring **21**, which is formed symmetrically with respect to a center of the head restraint **1**, which center is defined by a vertical plane, serves as an energy accumulator and is formed from a continuous spring steel wire. Starting from the center of the head restraint **1**, the double leg spring **21** is supported by a respective end section **22** on a metallic, cylindrical transverse rod **23** which is mounted in the support **5** parallel to the spindle **7**. Each end section **22**, which runs radially towards the spindle **7** from the transverse rod **23**, is adjoined laterally towards the outside by a respective winding section wound helically around the spindle **7**. The outer ends of the two winding sections are connected to a common, U-shaped bow section by means of which the double leg spring **21** acts upon the impact element **13**. The bow section comprises two legs **25** (e.g., pivotable

members) which protrude radially from the spindle **7** and form the outer ends of the double leg spring **21**, a respective bent portion **27** which runs towards the center of the head restraint **1** in a manner largely parallel to the spindle **7** and to which the impact element **13** is attached, and an intercepting tongue **29** in the center. The support **5**, in each case one leg **25**, the impact element **13**, and the respective lower rocker **15** in each case form a four-bar linkage **31**.

The double leg spring **21** is held in the starting position by a latch **33**; the latch **33** has a latch mouth that receives the intercepting tongue **29**. As a projection from the central plane, the intercepting tongue **29** runs approximately perpendicularly to the legs **25**. The latch **33** is mounted pivotably on the transverse rod **23**. The latch **33** is prestressed in relation to the support **5** in the opening direction by means of a spring which is weak in comparison to the double leg spring **21**. The latch **33** is held by a lever mechanism (not shown in the drawings) and ultimately by a magnet system.

In the event of a rear-end crash, an electromagnet of the magnet system receives a pulse and releases the lever mechanism which releases the latch **33**. As a result, the relaxing double leg spring **21** can press the impact element **13** forward and at the same time can open the latch **33**. This triggers the crash-active head restraint **1**. With the four-bar linkages **29** extending, the impact element **13** "shoots" forward into a crash position.

The crash-active head restraint can be reset after a crash, i.e. can be brought reversibly into the starting position. For this purpose, a tool (not shown in the drawings) is introduced into the support **5** and the lever mechanism reset. By means of manual pressure from the front against the impact element **13**, preferably using both hands, the impact element **13** can then be moved rearwards again, counter to the force of the double leg spring **25**, towards the latch **33** which is ready to receive it. As soon as the intercepting tongue **29** comes to bear against the latch **33**, the latch **33** is rotated into its starting position and is held there. In a modified embodiment, first of all the impact element **13** can be pressed back and then the lever mechanism can be reset.

It will be understood by those skilled in the art that while the present invention has been discussed above with reference to an exemplary embodiment, various additions, modifications and changes can be made thereto without departing from the spirit and scope of the invention as set forth in the following claims.

What is claimed is:

1. A head restraint that is for a vehicle seat and capable of operating advantageously in response to a crash, the head restraint comprising:

a support;

at least two pivotable members that are carried by the support for respectively pivoting about horizontal axes;

an impact element that is connected to the pivotable members so that the impact element together with the pivotable members and the support forms at least one four-bar linkage; and

a spring that is for accumulating energy and for driving said four-bar linkage in response to the crash, wherein

the head restraint is configured so that the impact element will move forwardly, from a starting position to a crash position, in response to said four-bar linkage being driven by the spring, and

the spring includes at least one leg, and the leg of the spring is one of the pivotable members of said four-bar linkage, so that said four-bar linkage is formed by

(a) the support,

(b) the leg of the spring being carried by the support for pivoting relative to the support about a first of the horizontal axes,

(c) a second of the pivotable members being carried by the support for pivoting relative to the support about a second of the horizontal axes,

(d) the impact element being pivotably connected to the leg of the spring, and

(e) the impact element being pivotably connected to the second pivotable member at a position that is distant from where the impact element is pivotably connected to the leg of the spring.

2. The head restraint as claimed in claim **1**, wherein the leg of the spring protrudes radially from the first axis.

3. The head restraint as claimed in claim **2**, wherein the leg is an outer portion of the spring.

4. The head restraint as claimed in claim **2**, wherein the spring has a bent portion, the bent portion of the spring is connected to the leg of the spring, the bent portion of the spring is fastened to the impact element, and the impact element is pivotably connected to the leg of the spring by way of the bent portion of the spring being fastened to the impact element.

5. The head restraint as claimed in claim **2**, wherein:

the spring has an intercepting tongue;

the intercepting tongue is held by a latch while the impact element is in the starting position; and

the latch is mounted on the support.

6. The head restraint as claimed in claim **2**, wherein the leg of the spring is positioned above the second pivotable member, whereby the leg of the spring is an upper pivotable member of said four-bar linkage, and the second pivotable member is a lower pivotable member of said four-bar linkage.

7. The head restraint as claimed in claim **2**, wherein:

the leg of the spring is a first leg,

the spring includes a second leg, and

the first and second legs of the spring are arranged symmetrically with respect to a center of the head restraint.

8. The head restraint as claimed in claim **2**, wherein the spring is a continuous piece of spring steel wire.

9. The head restraint as claimed in claim **2**, wherein another leg of the spring is at least partially supported on a metallic transverse rod, and the transverse rod is carried by the support.

10. The head restraint as claimed in claim **1**, wherein the leg of the spring is an outer portion of the spring.

11. The head restraint as claimed in claim **10**, wherein the spring has a bent portion, the bent portion of the spring is connected to the leg of the spring, the bent portion of the spring is fastened to the impact element, and the impact element is pivotably connected to the leg of the spring by way of the bent portion of the spring being fastened to the impact element.

12. The head restraint as claimed in claim **1**, wherein the spring has a bent portion, the bent portion of the spring is connected to the leg of the spring, the bent portion of the spring is fastened to the impact element, and the impact element is pivotably connected to the leg of the spring by way of the bent portion of the spring being fastened to the impact element.

13. The head restraint as claimed in claim **12**, wherein the spring is a continuous piece of spring steel wire.

14. The head restraint as claimed in claim **1**, wherein:

the spring has an intercepting tongue;

the intercepting tongue is held by a latch while the impact element is in the starting position; and

the latch is mounted on the support.

15. The head restraint as claimed in claim **14**, wherein:

the leg of the spring is a first leg,

the spring includes a second leg,

the first and second legs of the spring are arranged symmetrically with respect to a center of the head restraint, and

the intercepting tongue is positioned between the first and second legs.

16. The head restraint as claimed in claim **14**, wherein the spring is a continuous piece of spring steel wire.

17. The head restraint as claimed in claim **1**, wherein the leg of the spring is positioned above the second pivotable member, whereby the leg of the spring is an upper pivotable member of said four-bar linkage, and the second pivotable member is a lower pivotable member of said four-bar linkage.

18. The head restraint as claimed in claim **17**, wherein:

the leg of the spring is a first leg,

the spring includes a second leg,

the first and second legs of the spring are arranged symmetrically with respect to a center of the head restraint,

said four-bar linkage is a first four-bar linkage, and

a second four-bar linkage includes

the second leg of the spring,

the impact element,

the support, and

a lower pivotable member that is carried by the support.

19. The head restraint as claimed in claim **18**, wherein the spring is a continuous piece of spring steel wire.

20. The head restraint as claimed in claim **1**, wherein:

the leg of the spring is a first leg,

the spring includes a second leg, and

the first and second legs of the spring are arranged symmetrically with respect to a center of the head restraint.

21. The head restraint as claimed in claim **1**, wherein the spring is a continuous piece of spring steel wire.

22. The head restraint as claimed in claim **1**, wherein the spring is at least partially supported on a metallic transverse rod, and the transverse rod is carried by the support.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 7,344,191 B2
APPLICATION NO. : 11/655949
DATED : March 18, 2008
INVENTOR(S) : Jürgen Schilling et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the claims:

Col. 3 line 48 thru Col. 4 line 12 replace claim 1 with the following:

1. A head restraint that is for a vehicle seat and capable of operating advantageously in response to a crash, the head restraint comprising:

a support;

at least two pivotable members that are carried by the support for respectively pivoting about horizontal axes;

an impact element that is connected to the pivotable members so that the impact element together with the pivotable members and the support forms at least one four-bar linkage; and

a spring that is for accumulating energy and for driving said four-bar linkage in response to the crash, wherein

the head restraint is configured so that the impact element will move forwardly, from a starting position to a crash position, in response to said four-bar linkage being driven by the spring, and

the spring includes at least one leg, and the leg of the spring is one of the pivotable members of said four-bar linkage, so that said four-bar linkage is formed by

(a) the support,

(b) the leg of the spring being carried by the support for pivoting relative to the support about a first of the horizontal axes,

(c) a second of the pivotable members being carried by the support for pivoting relative to the support about a second of the horizontal axes,

(d) the impact element being pivotably connected to the leg of the spring, and the impact element being pivotably connected to the second pivotable member at a position that is distant from where the impact element is pivotably connected to the leg of the spring.

Signed and Sealed this

Twenty-sixth Day of January, 2010

David J. Kappos

David J. Kappos
Director of the United States Patent and Trademark Office